CLAIMS

1. An optical disk including a substrate in the form of a disk having a hole formed through the center thereof, a recording layer on which information is recorded and lies on the substrate, and a hub provided in the center of the substrate;

the optical disk being characterized by satisfying the relationship of $Y/X \geqq 0.015$, where X and Y respectively denote the projected area of the substrate and the contact area between the hub and the substrate.

2. The optical disk according to Claim 1, and characterized by being an optical disk cartridge including a cartridge case, the disk being rotatable on an axis of rotation in the cartridge case, the case having inner walls defining a space having a size along the axis of rotation, the size being 300 or more % of the thickness of the substrate.

3. The optical disk according to Claim 2, and characterized in that the inner walls of the cartridge case have a recess and a protrusion that face the disk for adjusting the air flow in the case while the disk is rotating.

4. The optical disk according to Claim 1, characterized in that the hub has a convex center portion with a side wall sloping

at an angle between 130 and 160 degrees at half the height of the hub.

5. The optical disk according to Claim 4, characterized in that the hub is formed out of a material that is attractable by a magnet.

6. The optical disk according to Claim 5, characterized in that the hub is made of a metallic magnetic material selected from a group consisting of Fe, Ni, Co and an alloy thereof.

7. The optical disk according to any one of Claims 1 through 6, characterized in that the substrate has a thickness of 0.7 or less mm.

8. The optical disk according to any one of Claims 1 through 6, characterized by being rotated at a speed of more than 720 rpm for recordation and reproduction.

9. The optical disk according to any one of Claims 1 through 6, characterized in that the projected area X and the contact area Y satisfy the relationship of $Y/X \geqq 0.02$.

10. The optical disk according to Claim 9, characterized by being rotated at a speed of 2,400 or more rpm for recordation

and reproduction.

11. The optical disk according to any one of Claims 1 through 6, characterized in that the hub has an outer diameter that is 26 or more % of the outer diameter of the disk.

12. An optical disk including a substrate having a hole formed through the center thereof, a recording layer lying on the substrate, and a hub provided in the center of the substrate;

the optical disk being characterized by the hub having an outer diameter that is 26 or more % of the outer diameter of the disk.

13. A disk substrate in the form of a disk for an optical disk;

the disk substrate having an axis of rotation and being characterized by having a disk plane tilting substantially with respect to a plane perpendicular to the axis of rotation.

14. The disk substrate according to Claim 13, characterized by further comprising a hub that is magnetically attractable.

15. The disk substrate according to Claim 13, and characterized by having a thickness of less than 0.8 mm.

16. The disk substrate according to Claim 14, characterized by further comprising a cylindrical receptacle formed in the center thereof for holding the hub, the receptacle having a hole formed through the bottom thereof coaxially with the axis of rotation.

17. The disk substrate according to Claim 16, characterized by the disk plane tilting at an angle θ away from the bottom of the cylindrical receptacle, the angle θ satisfying the relationship of 1 mrad $\leqq \theta \leqq$ 20 mrad.

18. The disk substrate according to Claim 17, characterized by the hub being held movably in the cylindrical receptacle.

19. The disk substrate according to Claim 18, characterized in that the disk substrate has a thickness between 0.1 and 0.7 mm.

20. The disk substrate according to Claim 14 or 15, characterized by satisfying the relationship of $Y/X \geqq 0.015$, where X and Y respectively denote the projected area of the substrate and the contact area between the hub and the substrate.

21. The disk substrate according to Claim 14 or 15, characterized in that the hub has an outer diameter that is 26 or more % of the outer diameter of the substrate.

22. An optical disk which has the disk substrate according to Claim 14 or 15.

23. A substrate in the form of a disk for an optical disk; the substrate having an axis of rotation and being characterized by having a thickness of less than 0.8 mm and a disk plane tilting at a tilt angle θ with a plane perpendicular to the axis of rotation, the tilt angle θ ranging between 1 and 20 mrad (1 mrad $\leqq \theta \leqq$ 20 mrad).

24. The disk substrate according to Claim 23, characterized by further comprising a hub that can be magnetically attracted.

25. The disk substrate according to Claim 23, characterized in that the tilt angle θ ranges between 10 and 20 mrad (10 mrad $\leqq \theta \leqq$ 20 mrad).

26. The disk substrate according to Claim 25,

characterized by further comprising a cylindrical receptacle formed in the center thereof for holding the hub, the receptacle having a hole formed through the bottom thereof coaxially with the axis of rotation.

27. The disk substrate according to Claim 26, characterized in that the hub is held movably in the cylindrical receptacle.

28. The disk substrate according to Claim 23, characterized in that the disk substrate has a thickness between 0.1 and 0.7 mm.

29. The disk substrate according to Claim 24, 25 or 28, and characterized by satisfying the relationship of $Y/X \geqq 0.015$, where X and Y respectively denote the projected area of the substrate and the contact area between the hub and the substrate.

30. The disk substrate according to Claim 24, 25 or 28, and characterized by the hub having an outer diameter that is 26 or more % of the outer diameter of the substrate.

31. An optical disk including the disk substrate according to Claim 24, 25 or 28.

32. A driving apparatus for driving a record disk including a hub that is magnetically attracted to press the record disk, the disk having a tilt;

the driving apparatus being characterized by including a support for supporting a part of the record disk to adjust the tilt of the disk.

33. The driving apparatus according to Claim 32, characterized in that the record disk has an axis of rotation and a disk plane substantially tilting with respect to a plane perpendicular to the axis of rotation.

34. The driving apparatus according to Claim 32, characterized in that the record disk has an axis of rotation, a thickness of less than 0.8 mm and a disk plane tilting at a tilt angle θ with a plane perpendicular to the axis of rotation, the tilt angle θ satisfying the relationship of 1 mrad $\leqq \theta \leqq$ 20 mrad.

35. The driving apparatus according to Claim 32, characterized in that the record disk has an axis of rotation and a cylindrical receptacle for holding the hub, the receptacle having a hole formed through the bottom thereof coaxially with the axis of rotation.

36. The driving apparatus according to Claim 33 or 34,

characterized by including a rotating shaft for rotating the record disk, the support being formed at the top of the shaft.

37. The driving apparatus according to Claim 35, characterized by including a rotating shaft for rotating the record disk; wherein the rotating shaft has a cylindrical recess formed coaxially in the top thereof for holding the cylindrical receptacle, the rotating shaft also has a side wall defining the recess, and the support is formed at the top of the side wall.

38. The driving apparatus according to Claim 37, characterized by the rotating shaft protruding axially from the bottom of the cylindrical recess, the shaft including:

a first columnar protrusion having an outer diameter larger than that of the hole in the bottom of the record disk; and

a second columnar protrusion protruding coaxially from the first protrusion axially of the rotating shaft.

39. The driving apparatus according to Claim 35, characterized by the disk plane tilting at an angle θ with a direction perpendicular to the axis of rotation away from the bottom of the cylindrical receptacle, the angle θ satisfying the relationship of 1 mrad $\leqq \theta \leqq$ 10 mrad.

40. The driving apparatus according to Claim 37, characterized in that the top of the cylindrical wall defining the recess of the rotating shaft extends radially outward.

41. The driving apparatus according to Claim 38, characterized in that, when the record disk is mounted on the driving apparatus, the hole of the disk engages with the second protrusion to support the disk plane of the disk on top of the horizontal support, whereby the disk plane is kept at an angle of 10 or less mrad with a plane perpendicular to the axis of rotation of the disk.

42. The driving apparatus according to Claim 36 or 37, characterized by the rotating shaft including a magnet fitted therein for attracting the hub.

43. The driving apparatus according to Claim 42, characterized in that the magnet is an electromagnet.

44. A driving apparatus for recording and reproducing information by radiating light onto the recording surface of a record disk including a hub that is magnetically attracted to press a part of the disk, characterized by comprising:

a light source for irradiating the record disk with light;

a tilt sensor for measuring the tilt angle of the recording

surface of the record disk relative to the optical axis of the light incident on the disk;

a rotating shaft for rotating the record disk;

an electromagnet embedded in the rotating shaft; and

a controller for controlling the magnetic field intensity of the electromagnet based on the tilt angle detected by the tilt sensor, and for adjusting the force with which the hub presses the disk plane of the record disk.

45. The driving apparatus according to Claim 44, characterized by the disk plane substantially tilting with respect to a plane perpendicular to the axis of rotation of the record disk.

46. The driving apparatus according to Claim 44, characterized by the record disk having a thickness of less than 0.8 mm, the disk plane tilting at a tilt angle θ with a plane perpendicular to the axis of rotation of the disk, the tilt angle θ satisfying the relationship of 1 mrad $\leqq \theta \leqq$ 20 mrad.

47. The driving apparatus according to Claim 44, characterized by the record disk including a cylindrical receptacle for holding the hub, the receptacle having a hole formed through the bottom thereof coaxially with the axis of rotation of the disk.

48. The driving apparatus according to Claim 45, 46 or 47, characterized in that the controller controls the electromagnet to rotate the record disk so that the disk plane makes an angle of 10 or less mrad with the plane perpendicular to the axis of rotation.

49. The driving apparatus according to Claim 47, characterized in that the disk plane tilts at an angle θ with a direction perpendicular to the axis of rotation away from the bottom of the cylindrical receptacle, the angle θ satisfying the relationship of 1 mrad $\leqq \theta \leqq$ 20 mrad.

50. The driving apparatus according to Claim 47, characterized in that the rotating shaft includes a support on top, on which the cylindrical receptacle can rest, the support includes:

a first columnar protrusion protruding coaxially with the rotating shaft and having an outer diameter larger than that of the hole in the bottom of the record disk; and

a second columnar protrusion protruding from the first protrusion coaxially with the rotating shaft.

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